

## Exploration Blasting Associated with Shale Gas Extraction

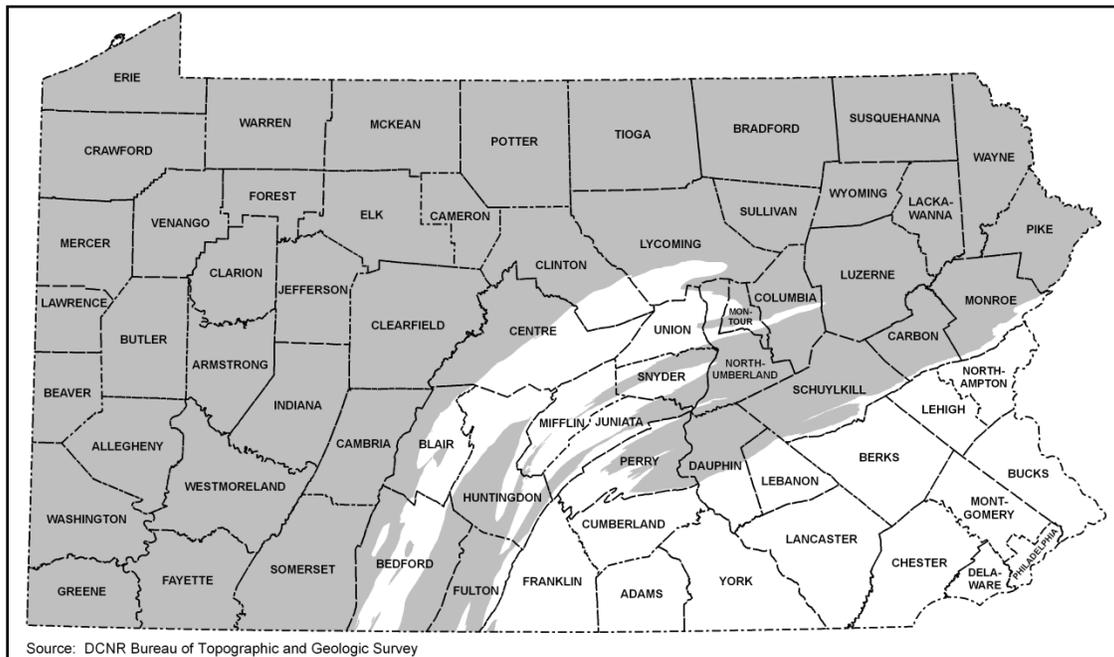
Shale gas drilling and associated seismic exploration activities are increasing in the commonwealth. Seismic exploration activities often generate questions and concerns from nearby landowners, particularly regarding the use of explosives in the exploration process. This fact sheet provides general information and answers to some basic questions regarding explosives use for seismic exploration related to shale gas extraction.

### What is seismic exploration?

Seismic exploration operations are able to map deep gas-producing zones by generating vibrations that travel through the ground. These vibrations reflect back to the surface where they are measured by sensitive instruments. The information gathered is then used to produce subsurface maps which allow gas companies to target areas for drilling operations. In densely populated areas or other locations where explosives use is not practical, seismic exploration is conducted using large, heavy trucks called “vibe trucks”. The trucks place vibratory plates on the ground to generate the vibrations. In other areas explosive charges are used to generate the vibrations.

### Where in the state are shale gas exploration activities taking place?

Shale gas exploration is primarily occurring in areas overlying the Marcellus Shale formation, which includes large portions of western, northern and northeastern Pennsylvania noted in gray in the map below.



### How are explosives used to support seismic exploration?

The small high explosives charges used in seismic exploration operations are similar to the small high explosives charges used in mining and construction to detonate larger amounts of explosives. However, the detonation of explosives used in seismic exploration is not intended to break rock as it is in mining and construction. The goal is to produce a vibration wave that will travel into the ground to help map the subsurface.

In small-scale, 2-D seismic exploration operations, 20-foot deep, 3-inch diameter holes are drilled in a line. These holes are loaded with small explosive charges. Crushed stone is placed on top of the explosives. The crushed stone confines the energy of the detonation allowing the vibration wave to travel down through the ground while reducing the energy released at the top of the hole. In 2-D exploration, the explosives are usually detonated the same day they are loaded. The charges are placed no closer than 300 feet from buildings or water supplies, including private wells or springs.

In large-scale, 3-D seismic exploration operations, 20-foot deep, 3-inch diameter holes are drilled in a rectangular pattern on an approximately 200-foot by 200-foot grid. The holes are loaded with small explosive charges and the remainder of each hole is filled with crushed stone as they are in 2-D operations. 3-D projects require the coordination of the placement of an extensive network of recording equipment over a vast area and the sequential detonation of a

large number of holes by several crews of workers. Due to the scale of these operations, explosive charges may remain in the ground for months prior to detonation. During this period, the seismic exploration operator must ensure that the charges remain undisturbed and secure.

### **What should I expect to see at seismic exploration sites?**

Seismic exploration operations that use explosives are conducted in two phases. The first phase consists of drilling boreholes and loading the explosive charges. Compact drill rigs that have all-terrain capability are used to drill the holes. These operations are usually conducted by two-man crews—a driller and an assistant. Sometimes, explosives are hauled in portable magazines mounted on the drills. Other times, explosives are supplied to the drilling or loading crew in all-terrain vehicles. Usually, there also will be some additional all-terrain vehicles to carry the material to back fill the holes after loading and to load tools and other supplies necessary to complete the operation.

The second phase of seismic exploration operations using explosives is laying out the recording equipment and detonating the explosives charges. On 2-D seismic exploration operations, and some small 3-D operations, the recording equipment is delivered to where it is used by all-terrain vehicles. On large 3-D projects, the recording equipment is delivered to where it is used by helicopters. The helicopters carry the recording equipment in large, brightly colored, usually orange or yellow, bags. The equipment is lowered to the recording crews on the ground. After the recording crews set up their grid of cables and position the portable recording devices, they detonate the explosives that were placed in the ground by the drilling or loading crews. The explosive charges are detonated sequentially. After all of the explosive charges have been detonated, the crews on the ground gather the recording equipment and prepare it for helicopter transportation.

### **Who regulates these activities?**

The Pennsylvania Department of Environmental Protection (DEP) is responsible for regulating the storage, handling and use of explosives in the commonwealth. This includes explosives used during seismic exploration operations. DEP regulations cover the following aspects of seismic exploration:

**Blaster's Licenses:** Before conducting blasting operations, a blaster must obtain a blaster's license. Candidates for a blaster's license must have on-the-job experience, attend a blaster's training course, and pass an exam specific to the category of license sought. On seismic exploration operations, a licensed blaster is responsible for loading explosives into the borehole or supervising the loading of explosives to ensure that the explosive products are not damaged during loading and that the charge is well confined. A licensed blaster also must be present at the detonation of explosive charges to secure an area around the detonation and ensure that the charge detonated properly.

**Blasting Activity Permits:** All blasting activities in Pennsylvania, including seismic exploration operations using explosives, require a blasting activity permit (BAP). DEP's blasting and explosives inspectors review applications for BAPs. Blasting and explosives inspectors are licensed blasters. The BAP application must include information that demonstrates that the blasting activity proposed can be conducted safely and in compliance with Pennsylvania's blasting regulations.

**Explosives Storage Licenses:** Explosives must be stored in explosives magazines approved and licensed by DEP. As with BAPs, storage license applications are reviewed by blasting and explosives inspectors. The explosives storage license application must include information that demonstrates that the explosives storage proposed can be conducted in compliance with Pennsylvania's blasting regulations.

### **How do the blasting regulations protect the public?**

Pennsylvania's blasting regulations provide protection to people and property beyond the blast site as well as to personnel on the blast site. Standards are set to minimize the adverse effects of blasting to protect people and property. These standards are designed to reduce the risk of airborne rock and dust, reduce the propagation of near-surface ground vibrations, and limit the effects of air vibrations (airblast). The risk to people or property from seismic exploration operations is minimal due to the nature and scale of the explosives used. However, the regulations that apply to mining and construction blasting apply to seismic exploration operations as well.

Questions or complaints regarding blasting associated with shale gas exploration can be directed to the following District Mining Offices:

California District Office, 25 Technology Drive, California Technology Park, Coal Center, PA 15423, 724-769-1100

Cambria District Office, 286 Industrial Park Road, Ebensburg, PA 15931, 814-472-1900

Knox District Office, White Memorial Building, P.O. Box 669, Knox, PA 16232, 814-797-1191

Moshannon District Office, 186 Enterprise Drive, Philipsburg, PA 16866, 814-342-8200

New Stanton District Office, 131 Broadview Road, New Stanton, PA 15672, 724-925-5500

Pottsville District Office, 5 West Laurel Boulevard, Pottsville, PA 17901, 570-621-3118

For more information, visit [www.dep.state.pa.us](http://www.dep.state.pa.us), keyword: Blasting.